

Laucks

Testing Laboratories, Inc.

1008 Western Avenue, Seattle, Washington 98104 (206) 622-0727

Chemistry, Microbiology, and Technical Services

TES4-T10-5513-02-62-05-056D

Attachment D

5.56



Certificate

CLIENT Todd Shipyards Corporation
1801-16th Avenue S. W.
Seattle, WA 98124

LABORATORY NO. 70980

DATE Aug. 15, 1980

P.O. PS-49038

REPORT ON STEAM DISTILLATE

SAMPLE IDENTIFICATION Job #929.30/56.050

TESTS PERFORMED
AND RESULTS:

A sludge-like sample was received and steam distilled according to ASTM Method D-322. The steam distillate was then analyzed by capillary gas chromatography/mass spectrometry (GC/MS) with the resulting data being subjected to a computerized library search for tentative identification and quantitation.

The results are summarized as follows:

	%
Benzenes, substituted -----	24.2
Naphthalene -----	1.3
Naphthalenes, substituted -----	18.1
Alcohols -----	1.9
Aldehydes -----	1.7
Ketones -----	3.2
Others -----	14.4

	% -----		
	<u>Saturated</u>	<u>Unsaturated</u>	<u>Halogenated</u>
Hydrocarbons	26.4	4.8	4.0

Respectfully submitted,

Laucks Testing Laboratories, Inc.

Mike Nelson
Mike Nelson



MN:bg

This report is submitted for the exclusive use of the person, partnership, or corporation to whom it is addressed. Subsequent use of the name of this company or any member of its staff in connection with the advertising or sale of any product or process will be granted only on contract. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

USEPA SF



46014

ANDREA BEATTY RINIKER
Director



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

4350 - 150th Ave NE • Redmond, Washington 98052-5301 • (206) 885-1900

September 22, 1986

Todd Pacific Shipyard Corporation
Seattle Division
P.O. Box 3806
Seattle, WA 98124

Attn: Mr. Bruce Petrovic

Investigation of Groundwater Contamination from
Leaking Underground Solvent Tank

Dear Mr. Petrovic:

This is to confirm the requirements discussed during our meeting on September 22, 1986 regarding the leaking solvent tank. Specifically:

a. Backfill the holes from which the tank was removed and re-pave the area to limit infiltration.

b. Install a monitoring/recovery well no less than six (6) inches in diameter in the center of solvent tank excavation. The well should be encased in pea gravel or other washed, granular material of 3/8" or greater least mean diameter. The depth of the well should extend approximately two (2) feet below the water table at Mean Lower Low Water.

c. Analyze groundwater for contamination for the solvent and screen for other petroleum products. Results of all analyses should be submitted to this office for review.

d. Submit a letter report which briefly discusses the history of the tank, i.e. estimated date of installation, uses, contents, when and how the tank was determined to be leaking, immediate corrective action; results of all tests for soil contamination; MSDS for the material stored in the tank.

page 2

Todd Pacific Shipyard Corp.
Leaking Underground Tank
September 22, 1986

If you should find any other leaking underground tanks, you should submit a letter report to this office as soon as practicable which contains the information specified in d., above. Also, while I recognize that each situation is different, the protocol outlined above will essentially be the same, i.e. ground water monitoring and recovery operations, whenever there is evidence of leakage over an extended period of time or when the quantity lost cannot be determined.

If you have any questions or need further assistance, please contact me at 885-1900.

Sincerely,



Dan Cargill
District Inspector
Environmental Quality

DRC/dc

cc: Norm Peck, NWRO
Richard Koch, NWRO

REPORT OF MONITORING WELL INSTALLATION
AND GROUND WATER ANALYSES
SOLVENT TANK LOCATION NEAR BUILDING T-58

5 January 1987

Todd Pacific Shipyard Corporation
Seattle Division
P.O. Box 3806
Seattle, WA 98124

Attention Mr. Bruce Petrovic

Gentlemen:

REPORT OF MONITORING WELL INSTALLATION AND
GROUND WATER ANALYSES
SOLVENT TANK LOCATION NEAR BUILDING T-58

INTRODUCTION

This report describes the installation of a monitoring well and the results of ground water sampling and chemical analyses at the former location of a solvent tank located immediately north of Todd Building T-58. Petroleum or solvent odors were apparent at the time Todd personnel removed the tank and two nearby gasoline tanks on 20 September 1986, an indication of possible soil contamination around the tanks. Our services were requested by Messrs. Bruce Petrovic and Doug Briggs in early October 1986 to assist Todd in responding to a Washington Department of Ecology (WDOE) letter dated 22 September 1986 requiring, among other things, installation of a monitoring well and the analysis of ground water for chemical constituents.

Visual inspection of the tanks by Todd personnel after removal indicated that the solvent tank and one of the two gasoline tanks had probably leaked. We understand that the solvent tank was used to manage mineral spirits and Stoddard solvent. Mineral spirits are a grade of naphtha, which is a generic term referring to refined, partly refined, or unrefined petroleum products exhibiting certain distillation characteristics. Stoddard solvent is a petroleum distillate, also exhibiting specific distillation characteristics, although different than those of mineral spirits. The primary chemical constituents of both mineral spirits and Stoddard solvent are volatile organic compounds.

SCOPE

The scope of our services was arranged during verbal discussions between Messrs. Bruce Petrovic and Doug Briggs of Todd and Mr. William J. Enkeboll of Landau Associates on 14 October 1986. Specifically our scope consists of:

- a. Installing a monitoring well at the location of the removed solvent tank;
- b. Obtaining ground water samples and providing chemical analyses of the ground water in the well; and
- c. Preparing this written report.

FIELD WORK

Monitoring Well Installation: The WDOE letter established the following requirements for the monitoring well:

- a. The well should be at least 6 inches in diameter, located in the center of the solvent tank excavation.
- b. The well should be encased in pea gravel or other washed granular material of 3/8-inch or greater in diameter.
- c. The well should extend to a depth of approximately 2 feet below the water table at Mean Lower Low Water.

In a telephone conversation on 20 October 1986 with Mr. Enkeboll, Mr. Dan Cargill of the WDOE agreed that the monitoring well could be 4 inches in diameter to enable installation using commonly available hollow stem auger drilling equipment. The 4-inch well casing diameter would still enable the installation of pumping equipment, should recoverable quantities of gasoline or solvents be encountered.

The monitoring well was installed on 3 November 1986 to a depth of approximately 19 feet. The depth of the well had essentially been predetermined using the criteria described in the WDOE letter; that is, that the well should extend approximately 2 feet below the water table at Mean Lower Low Water. Since Mean Lower Low Water is defined as Elevation 0.0 and the general ground surface elevation in the area of solvent tank location is approximately Elevation 17 (referenced to Mean Lower Low Water), the well was planned for a depth of 19 to 20 feet.

Ground water was encountered during drilling at a depth of approximately 14 feet, and at a depth of approximately 9.6 feet during well development and ground water sampling. The difference between the water levels at these two times, four days

apart, is probably the result of ground water fluctuations in response to tidal action and the fact that ground water levels measured during well installation are influenced by the drilling and installation procedures, the effects which dissipate within a few days after the installation is completed. Overall, the ground water level appears to be higher than expected and, therefore, the well is installed to a depth greater than the approximately "2 feet below the water table at Mean Lower Low Water" established by the WDOE. In our opinion, however, this will not affect the quality of the ground water samples collected from the monitoring well nor the conclusions developed as a result of our services.

The monitoring well was installed at the location shown on the Site Plan, Figure 1. The details of well construction and the profile of the soil conditions encountered are shown on Figure 2. The soil classifications indicated on Figure 2 are referenced to the Unified Soil Classification System, described on Figure 3.

Well Development and Ground Water Sampling: Following installation, the monitoring well was developed using a small hand pump to remove sand and silt from the well and to flush silt sized particles from the pea gravel pack surrounding the well screen. Approximately 90 gallons of water were removed during the well development procedure.

A ground water sample was obtained from the well four days after the well was installed and developed. Approximately 18 gallons of water were removed from the well prior to retaining

the sample. The sample was collected using a stainless steel bailer fitted with a teflon bottom emptying device. Two 40 ml volatile organic analysis (VOA) vials, a 1 quart jar, and a 1 gallon bottle were filled. All containers were supplied by the analytical laboratory. The filled containers were stored on ice and delivered to the analytical laboratory within 24 hours of collection. The temperature, pH, and conductivity of the sample was measured in the field to be approximately 12 degrees Centigrade, 6.5, and 3200 micromhos, respectively.

RESULTS

Physical Conditions: The subsurface conditions encountered during well installation consisted of approximately 3 inches of asphalt surfacing which had been placed over brown silty fine to medium sand with occasional cobbles (base course material for the pavement) which extended to a depth of about 2 feet below the ground surface. Backfill (used to fill the excavation resulting from the tank removal) consisting of brown fine sand was encountered to a depth of about 8-1/2 feet. Black fine sand, probably hydraulic fill placed during the creation of Harbor Island, was encountered below 8-1/2 feet to the bottom of the boring at about 20.5 feet. The consistency of this black fine sand changed from loose to medium dense at a depth of approximately 14 or 15 feet.

Analytical Results: Chemical analyses were performed on the ground water sample collected from the monitoring well. The parameters and groups of chemicals analyzed are:

- o oil and grease
- o hydrocarbons
- o volatile organic compounds

Oil and grease was analyzed using Standard Methods (16th Ed) procedure 503B. Hydrocarbons were analyzed using Standard Methods (16th Ed) procedure 503E, and the volatile organic compounds were analyzed using EPA method 8240. The results of the analyses are provided in the attached analysis report. Only five volatile organic compounds (out of 31 specifically covered in the analytical procedure) were detected. The concentrations of these compounds, benzene 1,2-dichloroethane, methylene chloride, toluene, and xylene, are also listed in Table 1.

CONCLUSIONS AND RECOMMENDATIONS

Hydrocarbon products or solvents were not encountered in recoverable quantities during our study. However, some dissolved volatile organic constituents are present in the ground water at the former location of the solvent tank. As indicated in Table 1, the concentrations encountered were all below either the aquatic saltwater or aquatic freshwater water quality criteria, where established. The concentrations of benzene, 1,2-dichloroethane, methylene chloride, and xylene were higher than the human health or drinking water criteria for those parameters. However, the shallow ground water beneath Harbor Island is not currently used for drinking water purposes, and is very unlikely to be used as such in the future, because of its brackishness. It is our opinion that the human health or drinking water criteria do not apply in this situation.

TABLE 1
DETECTED VOLATILE ORGANIC COMPOUNDS

CONSTITUENT	CONCENTRATION (1)	CRITERIA (1)				
		AQUATIC SALTWATER		AQUATIC FRESHWATER		DRINKING WATER
		ACUTE	CHRONIC	ACUTE	CHRONIC	
Benzene	2190	5,100	NC (2) (3)	5,300	NC	RMCL = 0 (4) Proposed MCL=5 (5)
1,2-Dichloroethane	123	113,000	NC	118,000	NC	RMCL = 0 Proposed MCL=5
Methylene Chloride (Dichloromethane)	26	12,000	6,400	11,000	NC	0.19 (6)
Toluene	68	6,300	5,000	17,500	NC	RMCL = 2000
Xylene	1360	NC	NC	NC	NC	RMCL = 440

- (1) All concentrations are reported in parts per billions (ppb).
 (2) NC = no criterion established.
 (3) "Adverse effects" occur at concentrations above 700 ppb.
 (4) RMCL = recommended maximum contaminant level.
 (5) MCL = maximum contaminant level.
 (6) For cancer risk level of 1 in 1,000,000.

The receptor of concern in this area is the Duwamish Waterway, which is a mixture of fresh and salt water adjacent to the Todd facility (the percentages of fresh and salt water are dependent upon the tidal conditions and flow volume in the river). Even without the dilution that would occur should any of the ground water in the vicinity of the former solvent tank reach the Duwamish Waterway, the concentrations of the detected chemicals are below the aquatic water quality criteria. Therefore, it is our opinion that the ground water in the immediate vicinity of the monitoring well poses no apparent threat to the waterway.

Because hydrocarbon odors were noted during tank removal, well installation, and ground water sampling, any future excavation or subsurface work in the area should be conducted with proper attention to OSHA regulations. We also recommend that the ground water in the monitoring well be checked again for floating hydrocarbons or solvents and hydrocarbon odors within the next 1-2 months. Chemical analyses should be performed if floating product or strong odors are encountered, in which case analyses for oil and grease, hydrocarbons, and volatile organic constituents should be conducted.

* * * * *

We appreciate the opportunity to provide these services to you. If we can be of further assistance or if you have any questions, please contact us.



Yours very truly,

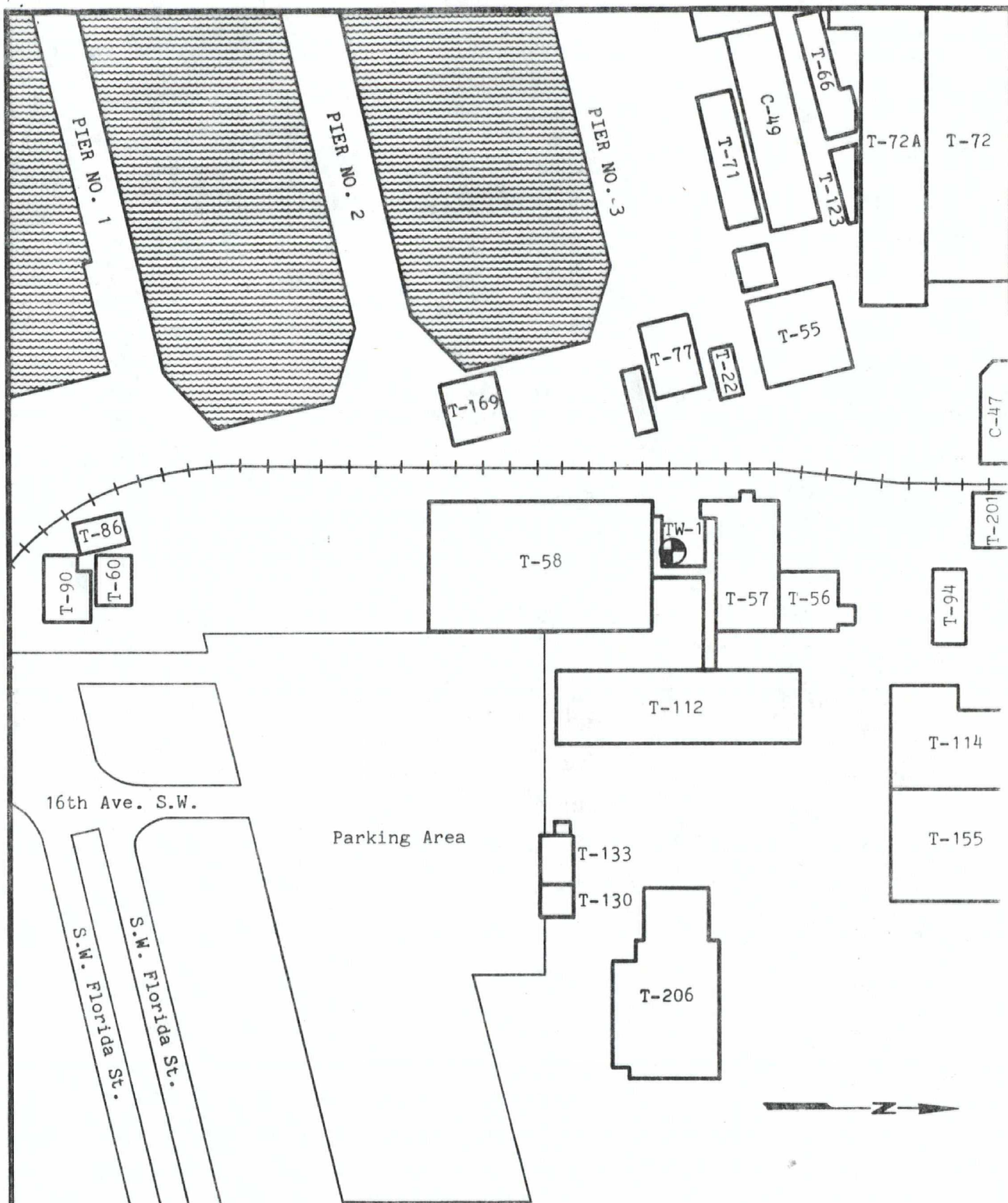
LANDAU ASSOCIATES, INC.

By:

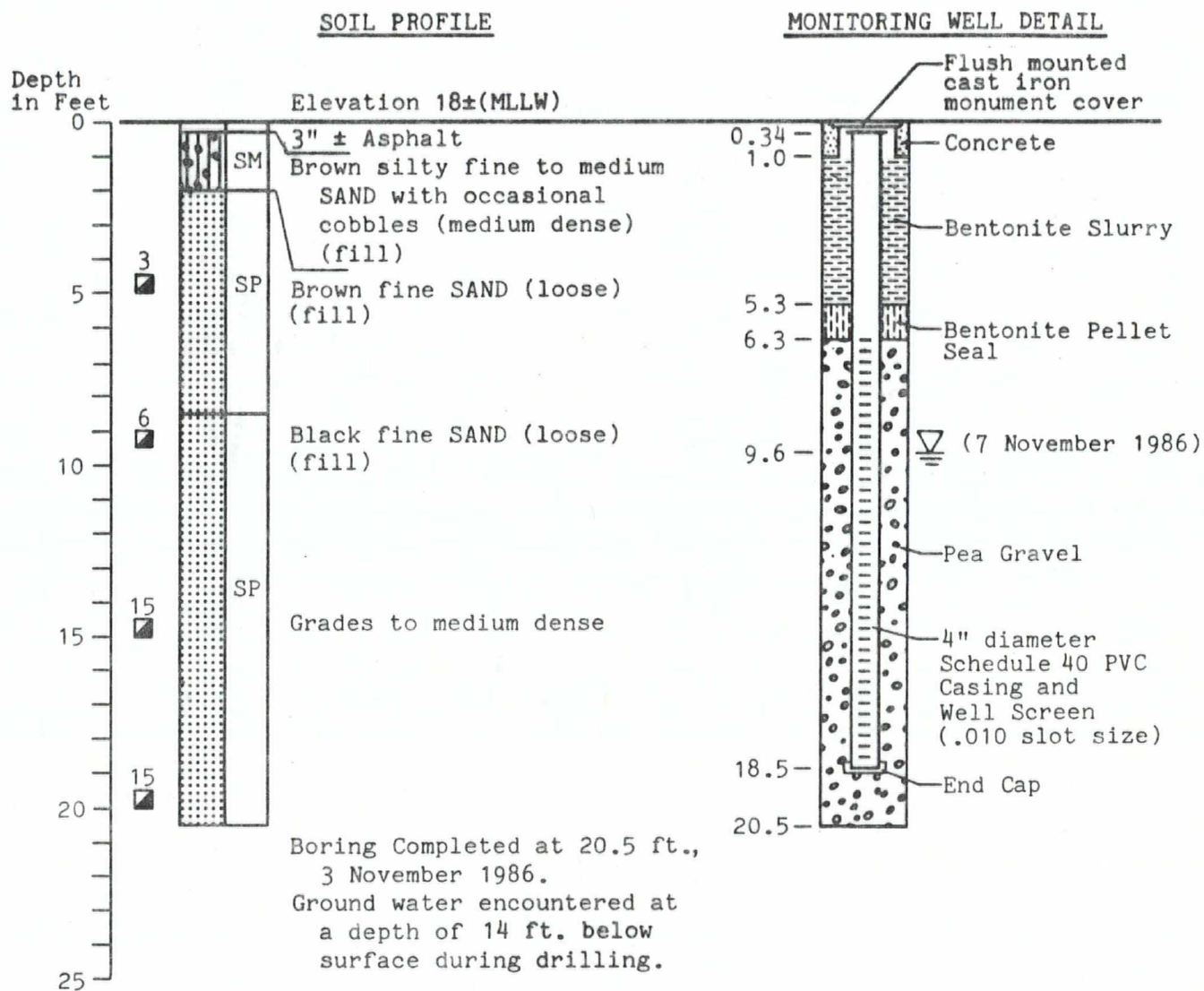
William J. Enkeboll

William J. Enkeboll, P.E.

WJE/ss
No. 32-04
Attachment

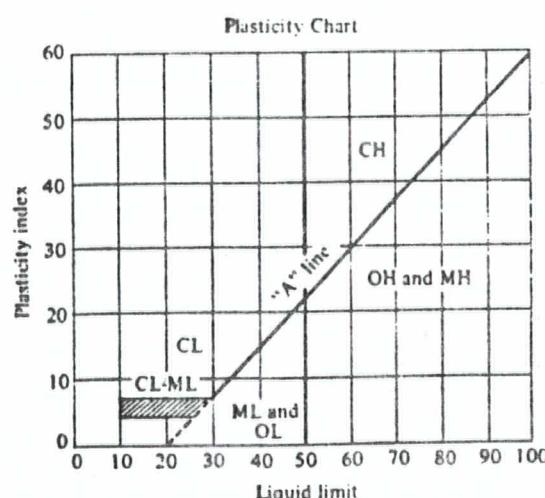


WELL TW-1



KEY

- 3 Disturbed soil sample obtained with 2.42-inch I.D. sampler; number refers to the number of blows required to drive the sampler 1 foot using a hammer weighing 300 pounds with a stroke of 30 inches.

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria						
<div>Coarse-grained soils (More than half of material is larger than No. 200 sieve size)</div> <div>Gravels (More than half of coarse fraction is larger than No. 4 sieve size)</div> <div>Clean gravels (Little or no fines)</div> <div>GW</div> <div>Well-graded gravels, gravel-sand mixtures, little or no fines</div> <div>GP</div> <div>Poorly graded gravels, gravel-sand mixtures, little or no fines</div> <div>Gravels with fines (Appreciable amount of fines)</div> <div>GM</div> <div>Silty gravels, gravel-sand-silt mixtures</div> <div>GC</div> <div>Clayey gravels, gravel-sand-clay mixtures</div> <div>Sands (More than half of coarse fraction is smaller than No. 4 sieve size)</div> <div>Clean sands (Little or no fines)</div> <div>SW</div> <div>Well-graded sands, gravelly sands, little or no fines</div> <div>SP</div> <div>Poorly graded sands, gravelly sands, little or no fines</div> <div>Sands with fines (Appreciable amount of fines)</div> <div>SM</div> <div>Silty sands, sand-silt mixtures</div> <div>SC</div> <div>Clayey sands, sand-clay mixtures</div>					<div>$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 6</div> <div>Not meeting all gradation requirements for GW</div>						
					<div>Atterberg limits below "A" line or P.I. less than 4</div> <div>Atterberg limits below "A" line with P.I. greater than 7</div> <div>Above "A" line with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols</div>						
					<div>$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3</div> <div>Not meeting all gradation requirements for SW</div>						
					<div>Atterberg limits above "A" line or P.I. less than 4</div> <div>Atterberg limits above "A" line with P.I. greater than 7</div> <div>Limits plotting in hatched zone with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols</div>						
					<div>Fine-grained soils (More than half material is smaller than No. 200 sieve)</div> <div>Silts and clays (Liquid limit less than 50)</div> <div>ML</div> <div>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity</div> <div>CL</div> <div>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays</div> <div>OL</div> <div>Organic silts and organic silty clays of low plasticity</div> <div>Silts and clays (Liquid limit greater than 50)</div> <div>MH</div> <div>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</div> <div>CH</div> <div>Inorganic clays of high plasticity, fat clays</div> <div>OH</div> <div>Organic clays of medium to high plasticity, organic silts</div> <div>Highly organic soils</div> <div>Pt</div> <div>Peat and other highly organic soils</div>					<div>Plasticity Chart</div> 	

LANDAU ASSOCIATES, INC.

UNIFIED SOIL CLASSIFICATION CHART